



# MULTIPLE USES OF DATA FROM AN AUTOMATED MONITORING NETWORK IN A 6-MILE URBAN STORMWATER TUNNEL

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# Presentation Outline

## 1. CRWD Background

- Organization
- Watershed Description
- CRWD Monitoring Program

## 2. Trout Brook Interceptor/Subwatershed

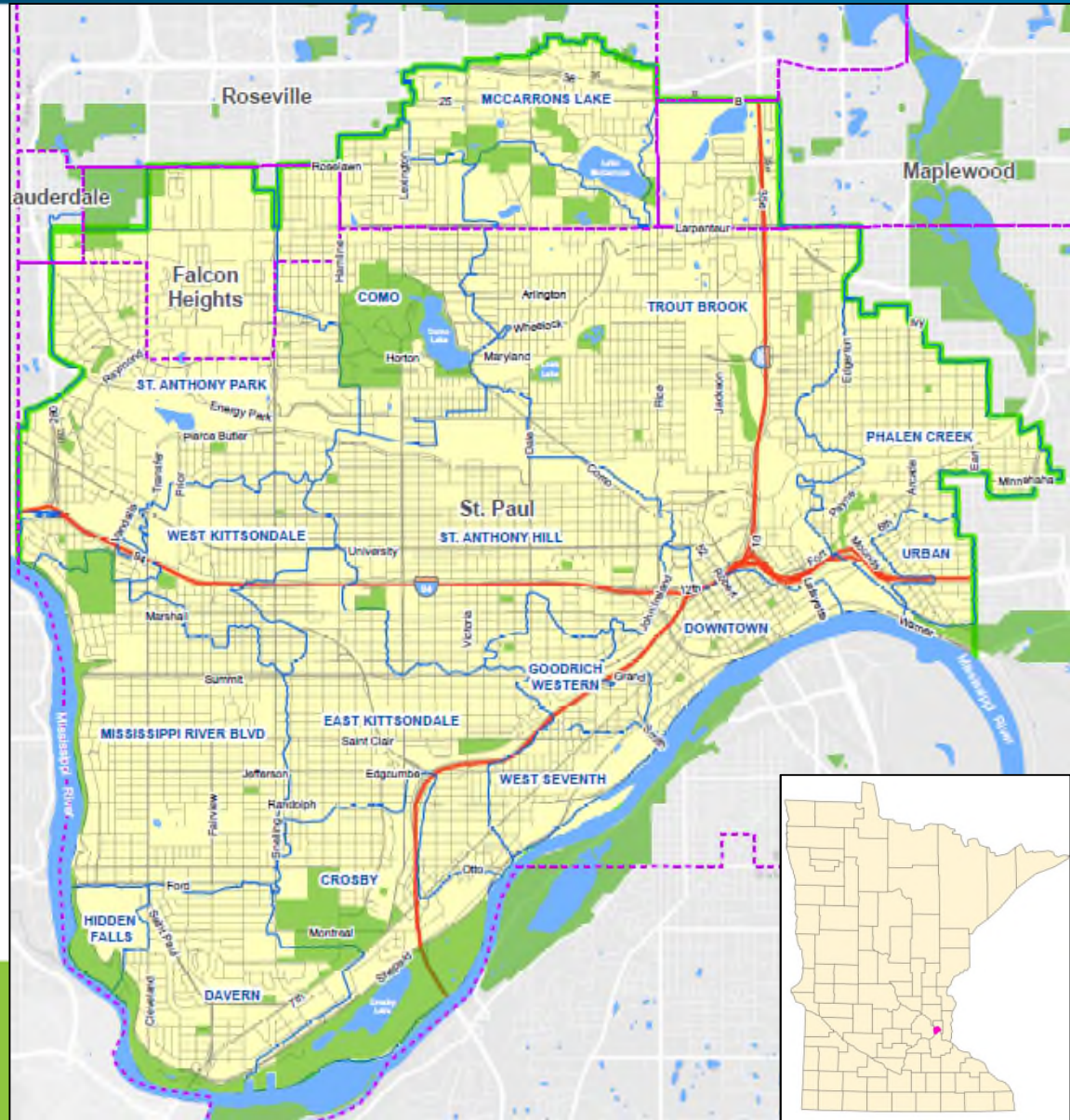
- History
- Monitoring Goals
- Monitoring Methods
- Data & Results
- Practical Application





# Capitol Region Watershed District

- Local unit of gov't
- Drainage area: **41 mi<sup>2</sup>**
  - Storm sewer network
  - 5 lakes
  - 13 mi. of Mississippi
- Population: **245,000**
- Highly urbanized
  - **42%+** impervious



# CRWD Monitoring Program

- Monitoring data foundation of CRWD
  - 10-yr program
- To Identify water quality problem areas
- Quantify runoff pollutant loading to Mississippi R.
- Evaluate BMP performance
- Data for model calibration
- Promote understanding of CRWD water resources





# MONITORING CASE STUDY:

## Trout Brook Interceptor & Subwatershed



# Background:

## Trout Brook Subwatershed

- 8,000 ac urban subwatershed
- Originally a natural channel
  - 1900-1950s: Put underground
- Drains to Mississippi R.
- 2 Lakesheds
  - Como & McCarrons
- Trout Brook Interceptor (TBI)  
Storm tunnel owned & operated by CRWD







# Trout Brook Interceptor (TBI)

- 6-mile storm tunnel
- 5-12 ft in diameter
- CRWD acquired TBI in 2006
- CRWD has MS4 Permit for TBI
  - Municipal Separate Storm Sewer System
  - Goals:
    1. Reduce discharge of pollutants
    2. Protect and improve water quality
    3. Comply with water quality requirements of Clean Water Act





# TBI Questions --

- How much water is discharging?
- What is the quality of the water?
- What is the quantity of annual pollutant loads to Mississippi R. from TB subwatershed?
- Are there trends in water quantity and quality?
- Where is the polluted water coming from?
- Does TBI safely & adequately convey runoff?

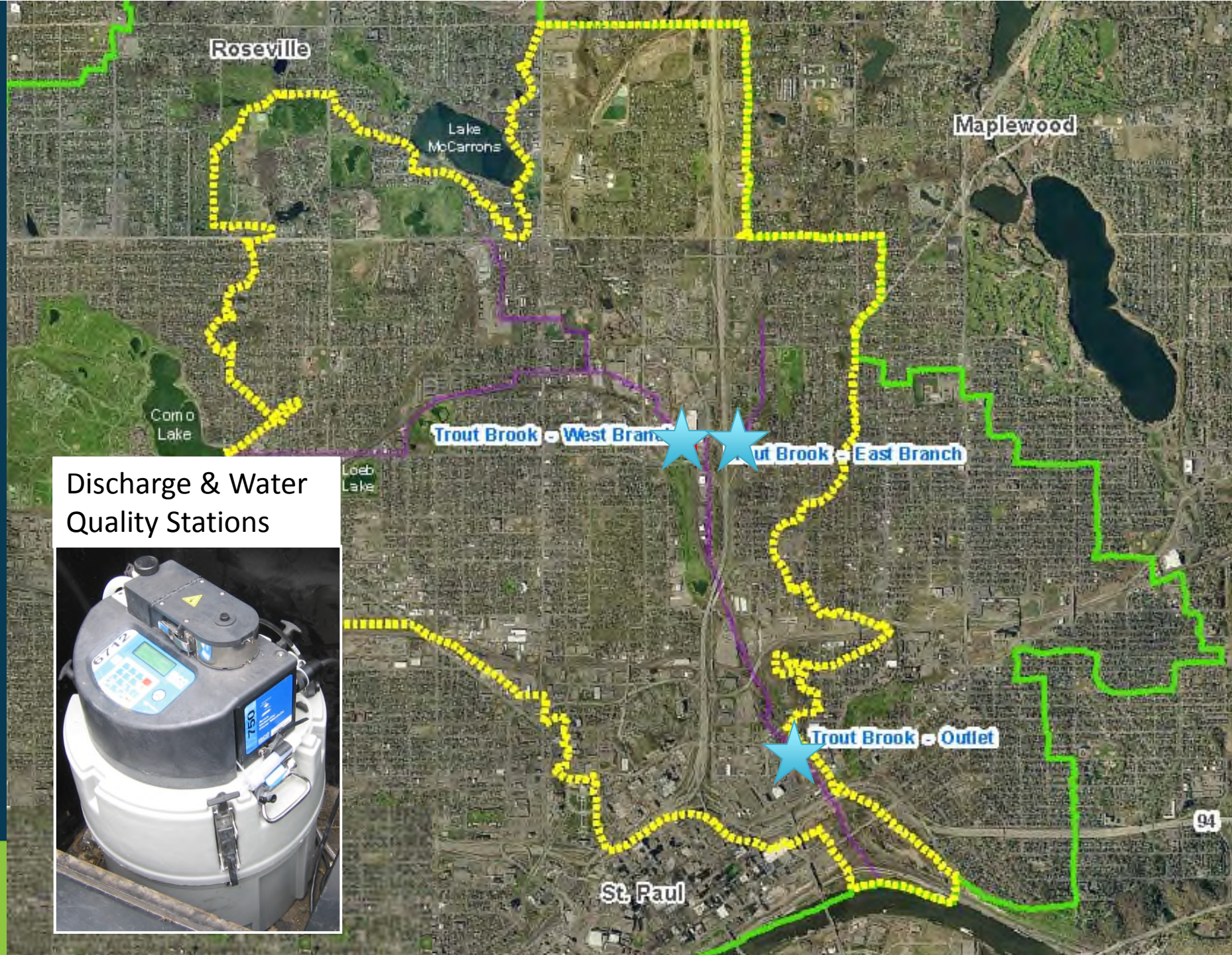


# Trout Brook Monitoring

- Monitoring began in 2005 (to present)
  - 9 year record
- Data to Characterize TB Sub-WS:
  - Precipitation
  - Discharge
  - Water Quality
  - Stormwater Pond Levels
  - Lakes:
    - Water Quality
    - Level
  - BMP Performance







Discharge & Water  
Quality Stations



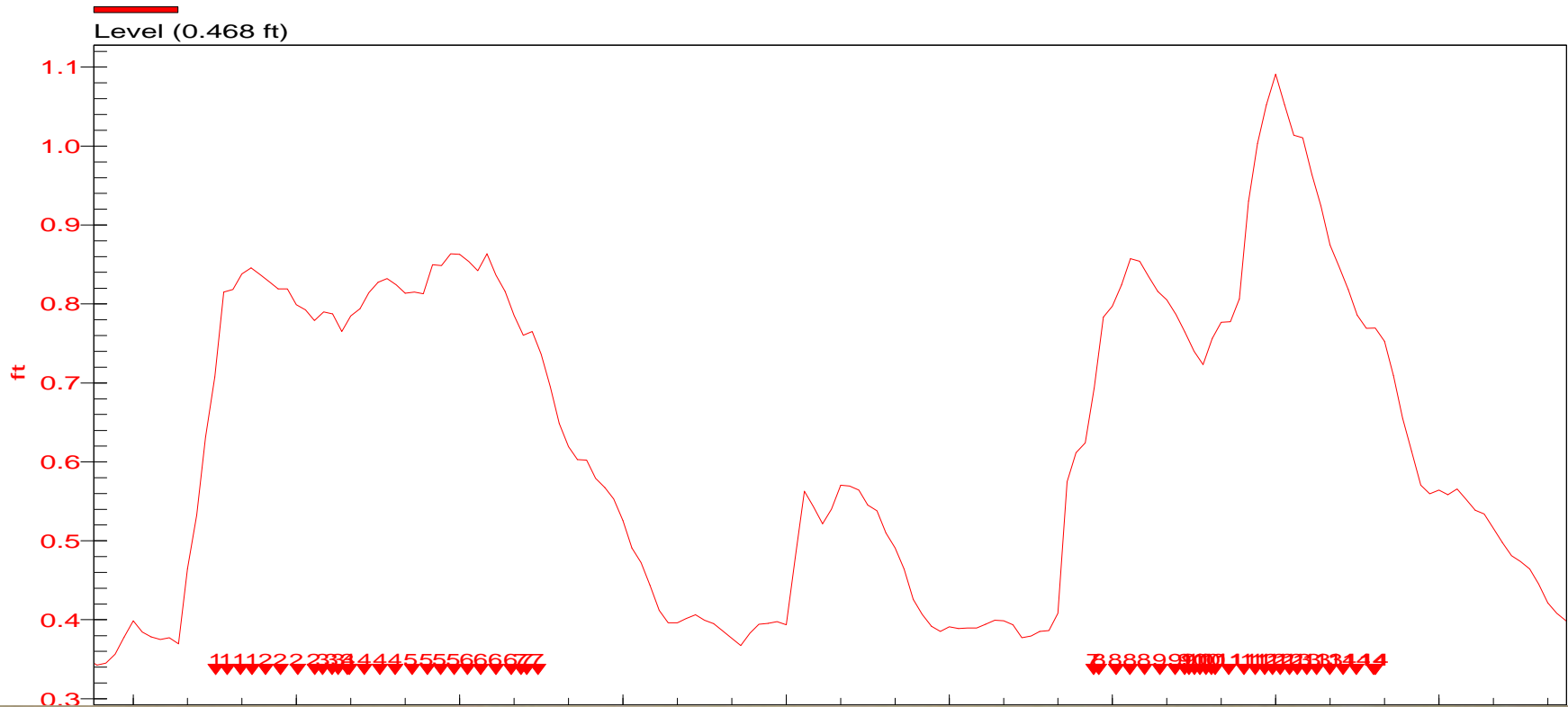


## Discharge & Water Quality Stations



# Storm Event Composite Samples

TB-1 WEST  
Flowlink 4 for Windows





# Trout Brook Monitoring Stations

## LAKES & PONDS:

- Lake Water Quality
- Level & Discharge
- 2 Lakes
- 6 Ponds







Precipitation Gauges





# What is Data Used For?



# What Is Data Used For?

## 1. Pollutant Loading Calculations:

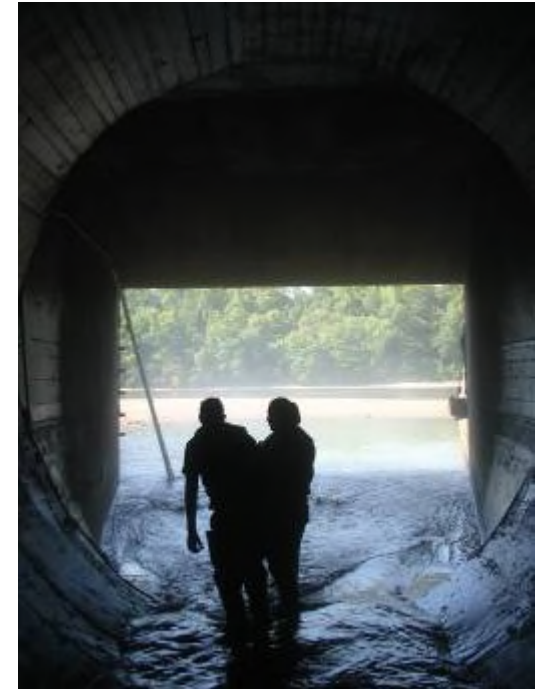
- Discharge, TP, & TSS

## 2. Hydraulic & Hydrologic Modeling:

- Conveyance & surcharge evaluation
- Operation & maintenance of TBI

## 3. Inform Project Design:

- Optimal BMP locations
- BMP construction
- Compliance verification for permits
- Tunnel replacement and rehabilitation

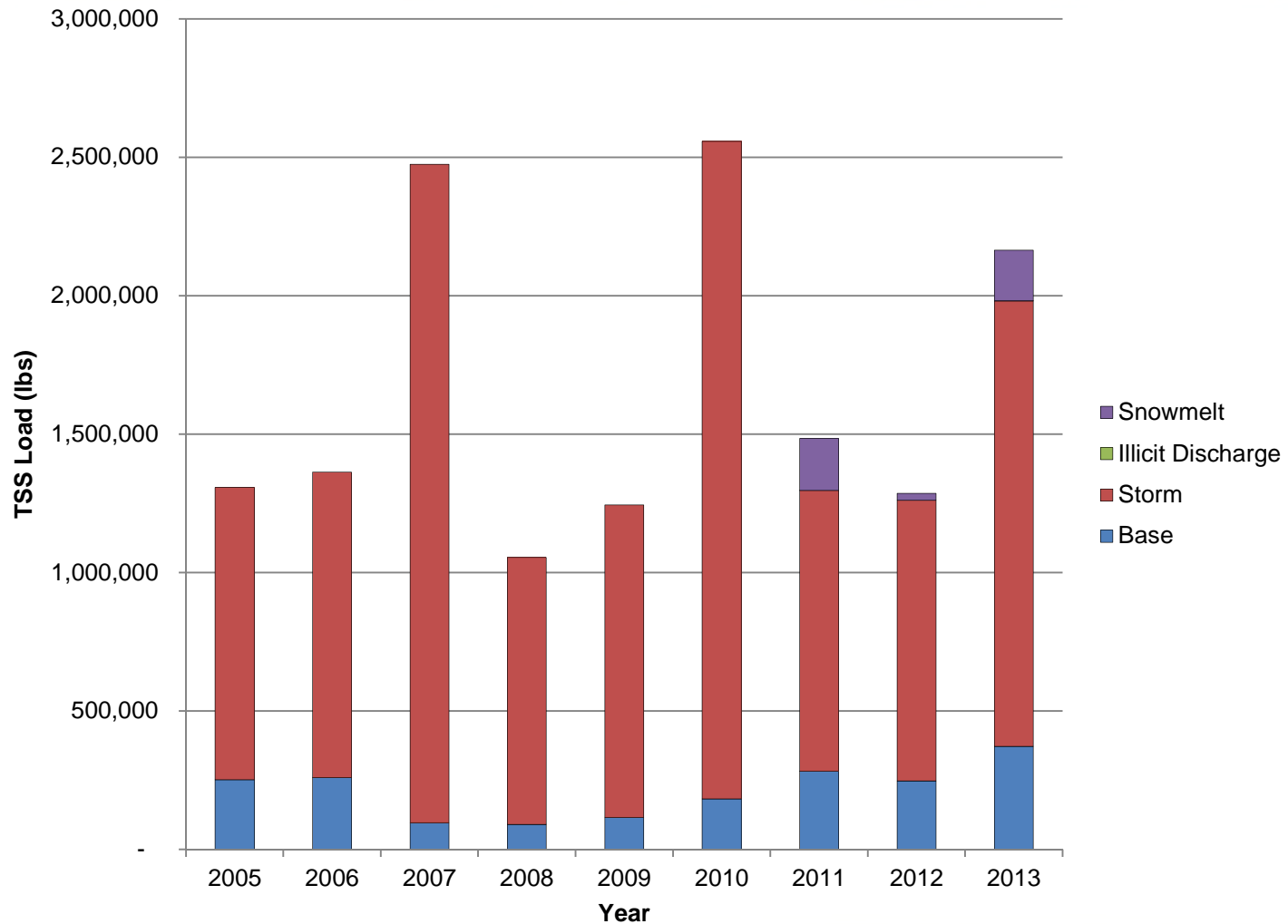




# Loading Calculations



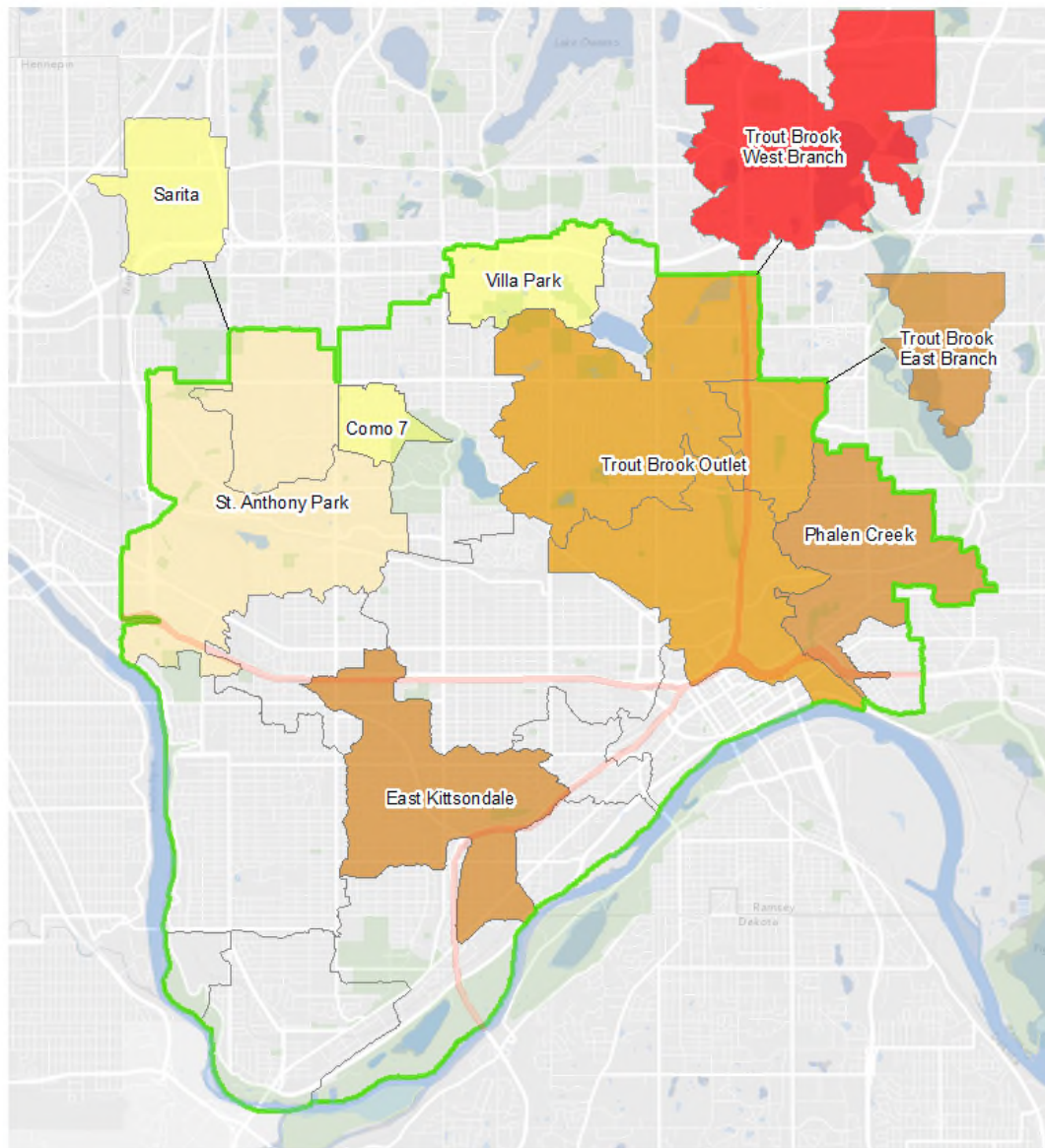
# Trout Brook Sub-WS Results



Total Suspended Solids (TSS)

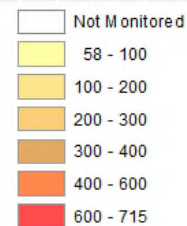
CAPITOL REGION WATERSHED DISTRICT





## Capitol Region Watershed District

2013 Total Suspended Solids Yields (lb/ac)



0 0.5 1 2 Miles

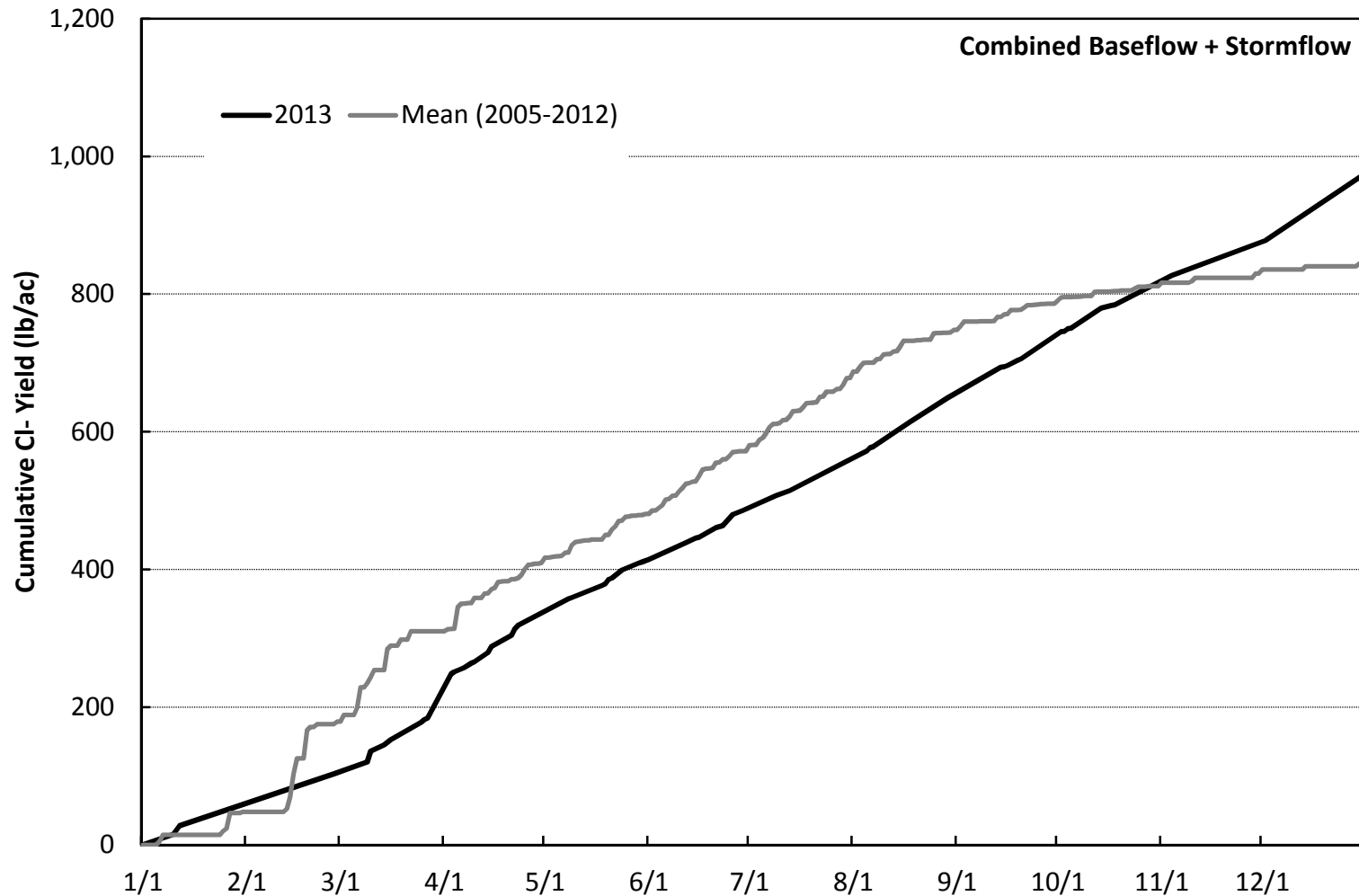


WATERSHED DISTRICT





# Trout Brook Sub-WS Results



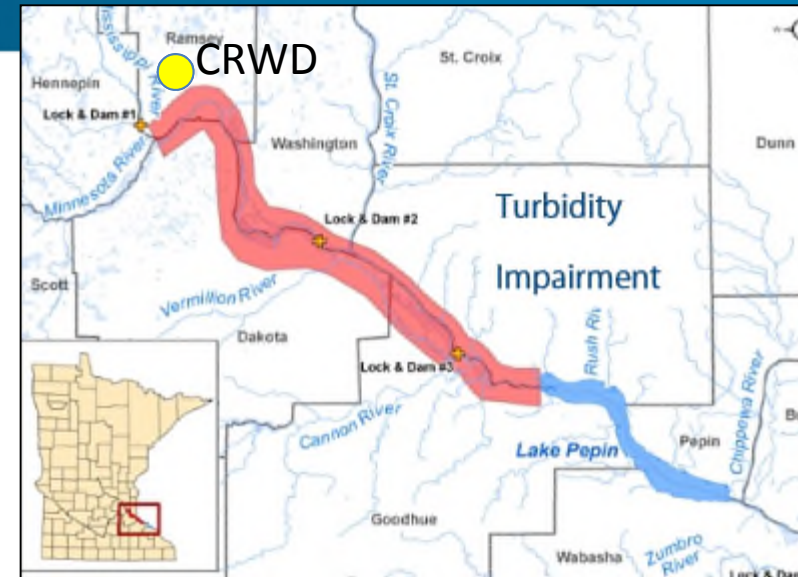
CHLORIDE (Cl-)

CAPITOL REGION WATERSHED DISTRICT



# Regional Uses of Loading Data

- TMDL development:
  - South Metro Mississippi R. Turbidity TMDL
  - Upper Mississippi R. Bacteria TMDL
  - Twin Cities Metro Area Chloride Project
- CRWD Annual Report
- Other regional uses of data:
  - Research/Academia
  - Other local orgs or municipalities





# Hydraulic & Hydrologic Modeling



# Hydraulic & Hydrologic Modeling

- **XP-SWMM:**
  - Hydraulics within tunnel
  - Document conveyance & surcharge issues in TBI
- **P8 Model:**
  - BMP Performance
  - BMP location identification
- Monitoring data to calibrate & validate models
  - Models rely on monitoring data



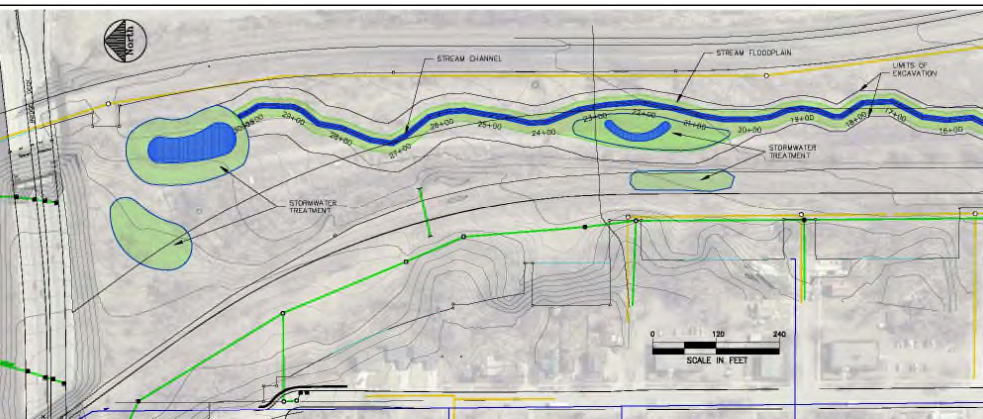


# Project Design

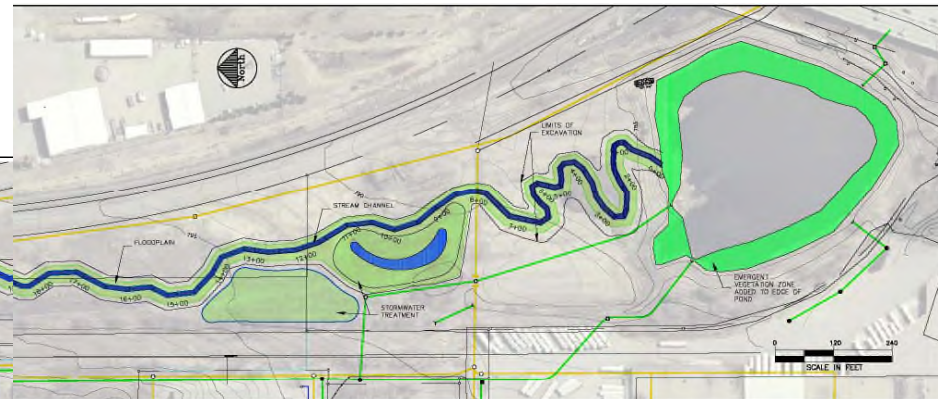


# Project Design

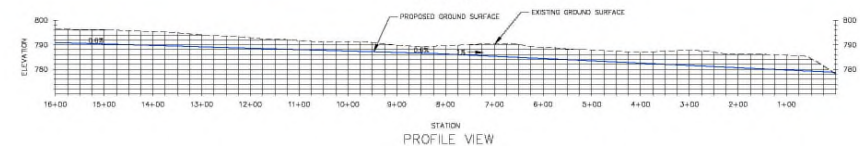
- Trout Brook Nature Sanctuary Project
  - Creation of 3,000 ft natural stream channel
  - “Daylighting” stormwater



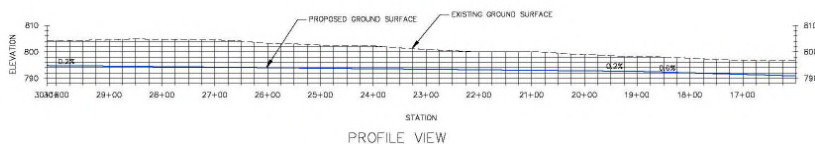
PLAN VIEW



PLAN VIEW



PROFILE VIEW



PROFILE VIEW



The background of the slide is a collage of four photographs. The top-left photo shows a dirt road or path with trees in the background. The top-right photo shows a grassy field with trees. The bottom-left photo shows a close-up of a gravel or stone surface. The bottom-right photo shows a construction site with a large pile of dirt and a worker in a yellow safety vest.

## **MONITORING DATA USED for:**

- Water source identification & flow calculations for perennial baseflow
- Diversion structure & lift station design
- Channel & floodplain design
- Stormwater treatment ponds
- Water chemistry— can stream support aquatic life?

# Project Design

## **MONITORING DATA USED for:**

- Tunnel Design & Sizing
- Bypass & water diversion structure design during construction
- Real-time flow data for day-to-day maintenance & tunnel entry





# Summary

- TBI monitoring will continue into future
  - Climate adaptation
  - Sub-sub watershed monitoring
  - Remote data access
- A comprehensive monitoring network is beneficial and allows us to:
  - Calculate loads
  - Calibrate/validate models
  - Inform project design & management decisions



# QUESTIONS?

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Capitol Region Watershed District

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